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(71) Applicant: **WACOAL CORPORATION**  
Kyoto-shi, Kyoto (JP)

(72) Inventor: **Fujimoto, Masami**  
Shimogyo-ku, Kyoto-shi (JP)

(74) Representative: **Nettleton, John Victor**  
**Abel & Imray**  
**Northumberland House**  
**303-306 High Holborn**  
**London, WC1V 7LH (GB)**

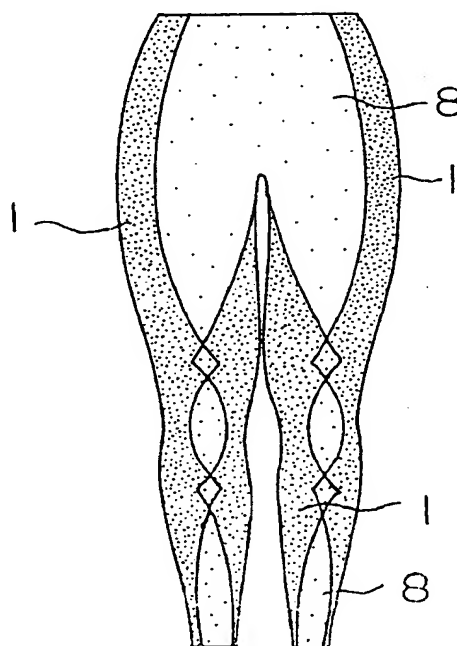
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(54) **Wearing article with strapping function**

(57) A wearing article with a strapping function for wearing on a human body in pressed relation to a surface of the human body, has a heavily-stretchable portion (1) which has an excellent tightening force and is adapted to be held against a required portion of the human body so as to extend generally along muscle fibers over a region from a tendon to a central portion of the muscle. The remainder of the wearing article is defined by an easily-stretchable portion (8). With this arrangement, by merely wearing this wearing article on the required portion of the body, the heavily-stretchable portion (1) tightens only a required portion of the body to support the central portion of the relevant muscle, thereby easily achieving a strapping function.

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## Description

### BACKGROUND OF THE INVENTION

This invention relates to wearing articles or clothes with a strapping function which are adapted to be worn on and tightly fitted on various parts of the human body so as to reinforce the relevant articulations (joints) and muscles.

When having various kinds of sport activities and trainings, or taking various kinds of exercise for fitness purposes, people put on the type of wear which prevents an external wound and prevents the relapse of a wound. In addition, in order to effectively prevent an injury and to provide an effective remedy, there has been widely used a so-called strapping treatment in which a suitable length of tape of an elastic nature or a nonelastic nature is tightly wound on or adhesively bonded tightly to the articulation, the muscle or the ligament of the human body in a perpendicular direction relative to the human body. Namely, the strapping treatment is used to prevent an injury, a wound resulting from fatigue, the relapse of such wound, or to provide an emergency treatment at the site immediately after an accident. After the injury is cured, the strapping is used for reinforcing the cured portion. Originally, the strapping is intended to reinforce the articulation and the muscle, using a medical or an athletic adhesive tape having an acrylic resin adhesive coated on one surface of a substrate of cotton or polyester, and this tape is adapted to be tightly wound on or adhesively bonded to a required portion of the human body so as to prevent an injury, to provide an emergency treatment, to promote rehabilitation and to prevent the relapse of an injury.

Besides such strapping, there have been widely used supporters which are made of an elastic material and adapted to be put on a portion of the human body, such as an ankle and a knee.

However, when the strapping is to be applied to a required portion of the human body, much skill is needed for such strapping treatment. If the strapping fails to be provided properly (for example, the application of the strapping to an improper portion, or unskillful and inadequate strapping), not only the intended purpose (i.e., the prevention of an injury and a remedy) is not achieved, but also this adversely affects various kinds of exercise, which may result in the interruption in blood circulation and neural trouble, and besides this tends to adversely affect the muscle. Therefore, it is necessary that the strapping should be applied by those who have acquired the technique of strapping, and unskilled persons cannot easily apply the strapping.

When a supporter is to be used, a suitable supporter of a configuration corresponding to a required portion of the human body is chosen, and it can be quite easily attached to the required portion. However, although the supporter can provide a support in a direction perpendicular to the human body surface, it can not

provide a required support force in a direction inclined relative to the human body surface, or in a spiral direction, or in a direction along the human body surface, so that sufficient support cannot be achieved because of insufficient tightening force. That is, such a supporter merely applies pressure to the human body, but cannot function to limit the movement of the relevant portion of the human body. Particularly when force is applied to the abdominal muscle or the like, the muscle is expanded and contracted, and therefore the muscle is expanded to increase its diameter. Therefore, when force is applied to the human body surface in perpendicular relation thereto, the expansion and contraction of the muscle are prevented, and fatigue is not alleviated, and in contrast this causes muscle fatigue.

In addition to the above-mentioned drawbacks of the prior art methods, another disadvantage has been encountered with the above strapping and the above supporters. More specifically, that portion of the human body surface to which the strapping or the supporter is applied is subjected to a tightening force, and therefore the difference between said that surface and the other surface portions appears because of the pressure difference, so that an unnatural step and profile can be recognized from the external appearance. This is quite unsightly, and particularly in the case of women, its silhouette cannot be kept beautiful.

WO-A-91/01794 is a document in the Japanese language of which the English-language abstract indicates that it discloses a covering article [for the human body] the main part of which is formed of a combination of elastic and non-elastic materials or of an elastic material only, in which specified parts of the elastic material are impregnated with treating agent so as to give different elasticity from the non-impregnated parts. The drawings include views of such an article applied to the knee, the ankle, the elbow, the wrist, and the shoulder.

The present invention provides a wearing article with a strapping function for wearing on the lower half of the human body in pressed relation thereto, the article including:

a tubular upper leg covering portion including a heavily-stretchable portion forming a part of the upper leg covering portion, and an easily-stretchable portion which forms the remainder of the upper leg covering portion, wherein:

the heavily-stretchable portion extends longitudinally of the upper leg covering portion along lateral portions thereof from an upper portion of the upper leg to a lower portion of the latter by way of lateral portions of the thigh, and

the parts of the heavily-stretchable portion which extend along one and the other of said lateral portions are joined together at a lower part of the upper leg covering portion so as to cover the portion of the upper leg which is located above and adjacent to the knee.

The heavily-stretchable portion is pressed against the portion (e.g. muscle or articulation) of the human body requiring a strapping treatment, in such a manner that the heavily-stretchable portion is extended along the muscle fibers over the region from the tendon to the central portion of the muscle. The other portions not requiring such a strapping treatment are covered by the easily-stretchable portion.

With this construction, the wearing article, when worn on the human body, has the portion applying a high tightening force to the body surface, and the portion applying a low tightening force to the body surface. The former portion applying the high tightening force achieves a localized tightening effect similar to that achieved with a strapping treatment, thereby enabling the prevention and remedy of an injury. The wearing article can be provided in the form of tights for the lower half of the human body, a sock and overall tights. Therefore, upon wearing of this wearing article, even those who are not skilful in the technique of strapping can obtain an effect similar to that of a strapping treatment. The other portion of the integral wearing article except for the strapping portion is made of a two-way stretchable material which can stretch longitudinally and transversely, and therefore the strapping portion can not be recognized from an external view, and the wearing article can be smoothly worn on the body with a beautiful silhouette.

Ways of carrying out the invention will now be described, by way of example only, with reference to Figure 5 of the accompanying drawings, in which:

Fig. 1 is a perspective view of a shirt in which heavily-stretchable cloth pieces are provided so as to be disposed on the shoulders and the upper arm portions;

Fig. 2 is a side-elevational view of an elbow supporter in which a heavily-stretchable cloth piece is provided so as to be disposed on the upper arm portion and the front arm portion;

Fig. 3 is a front-elevational view of a glove in which a heavily-stretchable cloth piece is provided so as to be disposed on the back of the hand, the palm and the wrist;

Fig. 4 is a rear view of an article of body wear in which heavily-stretchable cloth pieces are provided so as to be disposed on the back of the human body;

Fig. 5 is a front-elevational view of a long girdle according to an embodiment of the invention in which a heavily-stretchable cloth piece is provided so as to be disposed on the thighs and the lower leg portions;

Fig. 6 is a rear view of a long girdle in which a heavily-stretchable cloth piece is provided so as to be disposed on the hips;

Fig. 7 is a rear view of a lower leg supporter in which a heavily-stretchable cloth piece is provided so as to be disposed on the lower leg portion;

Fig. 8 is a front-elevational view of the lower leg supporter of Fig. 7;

Fig. 9 is a rear view of a modified lower leg supporter;

Fig. 10 a rear view of another modified lower leg supporter; and

Fig. 11 is a graph showing results of muscle fatigue tests.

The description of the articles of Figures 1 to 4 and 6 to 10 is included as a background to the embodiment of Figure 5.

Wearing articles or cloths with a strapping function which are adapted to be worn on the human body in pressed relation to the human body surface, will now be described with reference to the drawings.

Figs. 1 to 10 show various goods or articles. Fig. 1 shows a shirt in which a heavily-stretchable cloth piece is provided so as to extend from each shoulder to the upper arm portion to provide a strapping function. Fig. 2 shows an elbow supporter in which heavily-stretchable cloth pieces are provided so as to be disposed respectively at the upper arm portion and the front arm portion to provide a strapping function. Fig. 3 shows a glove in which a heavily-stretchable cloth piece is provided so as to extend along the back of the hand and the palm and also to surround the wrist to provide a strapping function. Fig. 4 shows an item of body wear in which heavily-stretchable cloth pieces are provided so as to hold the latissimus dorsi of the back of the human body and so on to provide a strapping function. Fig. 5 shows a long girdle according to the invention in which a heavily-stretchable cloth piece for providing a strapping function is provided so as to cover all of the front side of the lower half of the human body except for the front sides of the thighs, the knees and the front sides of the lower leg portions. Fig. 6 shows a long girdle in which a heavily-stretchable cloth piece is provided so as to hold the gluteus maximus muscles and etc., of the hips to provide a strapping function. Fig. 7 shows a lower leg supporter in which a heavily-stretchable cloth piece is provided so as to hold the Achilles' tendon, the soleus, the gastrocnemius and etc., to provide a strapping function. Fig. 8 is a front-elevational view of the lower leg supporter of Fig. 7. Fig. 8 is a rear-elevational view of a modified lower leg supporter. Fig. 10 shows another modified lower leg supporter in which heavily-stretchable cloth pieces are provided to extend from the Achilles' tendon via the opposite side portions of the gastrocnemius toward the knee. In any of these wearing articles, the heavily-stretchable cloth piece is adapted to be provided not perpendicularly to the surface of the human body, but linearly, slantingly or spirally (or in other suitable form) generally along the muscle fibers, so that the heavily-stretchable cloth piece can be pressed against the relevant portion of the human body surface.

The lower leg supports (particularly, those in which the heavily-stretchable cloth piece is provided to extend

from the Achilles' tendon via the opposite side portions of the gastrocnemius toward the knee) are now described specifically.

Each of the supporters A shown in Figs. 7 to 10 has a tubular shape, and is made of elastic (stretchable) materials (e.g. a spandex) sewn together. The supporter A fits on the lower leg to extend between the knee and the ankle so as to tighten this portion. The predetermined portion of the supporter A is lined with the heavily-stretchable cloth piece 1 in the form of a band. With this arrangement, when the supporter A is worn on the lower leg, the heavily-stretchable portion (where the heavily-stretchable cloth piece 1 is provided) is pressed against the human body surface with a higher tightening force so as to provide a strapping function, whereas the other portion of the supporter A (that is, an easily-stretchable cloth 8) is pressed against the human body surface with a lower tightening force. Thus, the supporter A has the two portions having different stretching (elastic) characteristics, respectively.

The heavily-stretchable cloth piece 1 is in the form of a band (360 denier x 210 denier) having a generally uniform width, for example, of 4 to 6 cm throughout its length, and is made of a heavily-stretchable material, such as a spandex, which can be stretched longitudinally with a relatively high force. The supporter A is lined with the band-like heavily-stretchable cloth piece 1 by sewing, so that this cloth piece 1 is integrally connected to the supporter A. In the supporter A shown in Fig. 10, one of the heavily-stretchable cloth pieces 1 extends downward from the upper portion 5 of the outer side of the lower leg (which is disposed slightly below the knee 4) toward the ankle obliquely to approach the center line of the rear side of the lower leg in such a manner that this heavily-stretchable cloth piece 1 is pressed against the upper outer portion of the gastrocnemius, part of the soleus and part of the Achilles' tendon. Reference numeral 2 denotes the upper end of this heavily-stretchable cloth piece 1, and reference numeral 3 denotes the lower end thereof. The other heavily-stretchable cloth piece 1 extends downward from the upper portion 6a of the inner side of the lower leg (which is disposed slightly below the knee 4) toward the ankle obliquely to approach the center line of the rear side of the lower leg in such a manner that this heavily-stretchable cloth piece 1 is pressed against the upper inner portion of the gastrocnemius, part of the soleus and part of the Achilles' tendon. In the supporter A shown in Fig. 10, although the two separate heavily-stretchable cloth pieces 1 are used, they may be replaced by a single heavily-stretchable cloth piece which is branched or bifurcated right and left at a position above the Achilles' tendon.

In the lower leg supporter A shown in Figs. 7 and 8, the heavily-stretchable cloth piece 1 extends spirally downward from the upper portion 5 of the outer side of the lower leg (which is disposed slightly below the knee 4) toward the ankle via the upper outer portion of the gastrocnemius of the calf 7 of the rear side of the lower

leg. Reference numeral 2 denotes the upper end of this heavily-stretchable cloth piece 1, and reference numeral 3 denotes the lower end thereof. In the lower leg supporter A shown in Fig. 9, the heavily-stretchable cloth piece 1 extends spirally in a direction opposite to that shown in Figs. 7 and 8. More specifically, the heavily-stretchable cloth piece 1 extends spirally downward from the upper portion 6a of the inner side of the lower leg (which is disposed slightly below the knee 4) toward the ankle via the upper inner portion of the gastrocnemius of the calf 7 of the rear side of the lower leg. Reference numeral 5a denotes the lower portion of the outer side of the lower leg.

In the above supporters A, the heavily-stretchable cloth piece 1 attached to the inner side thereof provides a higher tightening force than the other portion (that is, the easily-stretchable cloth 8) of the supporter A, and therefore the heavily-stretchable cloth piece 1 can provide strong stretching characteristics almost the same as achieved with a strapping treatment. When the band-like heavily-stretchable cloth piece 1 has a very much stronger stretching force than the easily-stretchable cloth 8, a strapping treatment for achieving a stronger support effect can be provided. More specifically, the heavily-stretchable cloth piece 1 is stretched or expanded, and then in this condition this cloth piece 1 is sewn to the easily-stretchable cloth 8. With this arrangement, when the supporter A is worn on the lower leg, the heavily-stretchable cloth piece 1 is stretched, and therefore the heavily-stretchable cloth piece 1 tends to contract, so that a strong contracting force is applied in the direction of the muscle fibers.

As described above, in the supporters A, band-like heavily-stretchable cloth piece 1, having uniform width throughout its length, is spirally provided. In other wearing articles to be worn on a required portion of the human body in pressed relation to the human body surface, the heavily-stretchable cloth piece 1 of a required shape is adapted to be provided on a required articulation or muscle so as to extend generally in the direction of the muscle fibers from the tendon to the central portion of the muscle. By doing so, a strapping function can be achieved. The heavily-stretchable cloth piece 1 is applied to the human body surface along the muscle fibers, and is applied under pressure to part or the whole of the muscle fibers. The heavily-stretchable cloth piece 1 need only to be extended longitudinally in the direction of the muscle fibers. When the heavily-stretchable cloth piece 1 is provided perpendicular to the human body surface, the muscle fatigue cannot be alleviated, and also a remedy for an injury can not be achieved. In other words, the dissipation of energy and the accumulation of a fatigue substance (e.g. lactic acid) cause muscle fatigue. The recovery from the fatigue can be promoted by promoting the flow of the blood and the lymph to rapidly remove the fatigue substance. When the skin is subjected to a massage effect by applying a proper degree of pressure thereto, the flow of the blood and the lymph can be promoted, and the recovery from the

fatigue can be promoted. However, when the muscular strength is exerted, the muscle fibers are contracted, and the muscle bundle becomes thicker, and it is not desirable to hold the central portion of the muscle (i.e., the thickened muscle bundle). In view of these, the above construction of the present invention is needed.

In Figures 7 to 10, although the heavily-stretchable cloth piece 1 is integrally sewn to the supporter A by lining, other possibilities exist. For example, there can be adopted a mold knitting method by which a high-power portion and a low-power portion are provided in a supporter, a molding method by which a high-power portion and a lower-power portion is provided in a supporter while providing a three-dimensional configuration, a method in which the heavily-stretchable cloth piece 1 is sewn to the outer side of the supporter, and a method in which instead of the heavily-stretchable cloth piece 1, a coating of a synthetic resin is applied to the supporter to prevent the stretching.

Preferably, fastening bands 9 and 9a of a tubular shape are attached respectively to the upper and lower ends 2 and 3 of the supporter A so as to prevent the supporter A from becoming displaced out of place upward and downward. This arrangement provides another advantage that the upper and lower fastening bands 9 and 9a pull the supporter A in opposite directions, so that the strapping function of the heavily-stretchable cloth piece 1 is enhanced. However, if the upper and lower ends 2 and 3 has sufficient power, the use of fastening bands 9 and 9a may be omitted. Further, the above lower leg supporters may be modified into a legging-type supporter in which a narrow strip is extended across the plantar arch.

Fig. 11 shows results of muscle fatigue tests with respect to the lower leg supporter of the present invention. In the test, electrodes were attached to the skin of the leg, and in this condition the testee ran on a slope for 10 minutes, and the average value with respect to the upper portions of the inner and outer sides of the gastrocnemius gas found, Mark ○ represents the numerical value measured immediately after the running was started, and mark ○ represents the numerical value measured seconds before the running was finished. As shown in Fig. 11, the degree of fatigue is low with high frequencies, and is high with low frequencies. B represents the case where no supporter was worn, and C represents the case where the supporter of the present invention was worn, and D represents the case where a conventional spat was worn, and E represents the case where a conventional tubular supporter for holding the central portion of the muscle was worn. As is clear from Fig. 11, by supporting the muscle without perpendicularly holding the central portion of the muscle, the stability of the muscle can be increased, and the fatigue resulting from a long-period exercise can be alleviated.

As described above with reference to Figures 7 to 10, the wearing article is composed of the easily-stretchable cloth 8 and the heavily-stretchable cloth

piece or pieces 1, and the heavily-stretchable cloth piece 1 is provided so as to extend generally along the muscle fibers over the region from the tendon to the central portion of the muscle. Therefore, when this wearing article is worn on the human body in intimate contact with the body surface, the heavily-stretchable cloth piece 1 is quite strongly pressed against the body surface along the muscle fibers so as to support the region from the tendon to the central portion of the muscle. With this arrangement, the stability of the muscle is enhanced, and good circulation of the blood and the lymph is obtained even when taking exercise for a long time, and muscle fatigue is alleviated. Therefore, with this strapping function, a torn muscle, which would be caused by the fatigue due to an excessive use of the muscle of the calf and by an excessive stress on the muscle, can be prevented, and a remedy for such a torn muscle can be achieved, and besides the prevention of an injury by a blow against the lower leg, as well as a treatment for such an injury, can be provided.

Further, when wearing the wearing article of the present invention, the same effect as the strapping treatment can be provided at the required portion extending along the central portion of the muscle, and besides upon wearing of the wearing article, even those who are not skilful in the strapping treatment can have the strapping support effect, and also tightening pressure can be applied to part of the body.

Further, since the band-like heavily-stretchable cloth piece 1 which is strong and can apply a high tightening force is used, the motion of the muscle is suitably supported and controlled. Also, that portion except for the heavily-stretchable cloth piece 1 which portion covers and fits on the body surface is as elastic (stretchable) as that obtained with the prior art, and therefore excellent fitting, heat-retaining and protective properties are obtained.

Further, the one-piece cloth, having the high-power portion and the lower-power portion continuous with each other, is used, and therefore the silhouette upon wearing is smooth and beautiful, and no profile of the high-power portion or the low-power portion appears on the outer surface of the wearing article.

#### Claims

1. A wearing article with a strapping function for wearing on the lower half of the human body in pressed relation thereto, the article including:

a tubular upper leg covering portion including a heavily-stretchable portion (1) forming a part of the upper leg covering portion, and an easily-stretchable portion (8) which forms the remainder of the upper leg covering portion, wherein: the heavily-stretchable portion (1) extends longitudinally of the upper leg covering portion along lateral portions thereof from an upper

portion of the upper leg to a lower portion of the latter by way of lateral portions of the thigh, and the parts of the heavily-stretchable portion (1) which extend along one and the other of said lateral portions are joined together at a lower part of the upper leg covering portion so as to cover that portion of the upper leg which is located above and adjacent to the knee. 5

2. A wearing article according to claim 1, in which a tubular lower leg covering portion of the article has an upper end integral with the lower end of the upper leg covering portion, and the lower leg covering portion includes: 10

a heavily-stretchable portion (1) forming a part of the lower leg covering portion, and an easily-stretchable portion (8) forming the remainder of the lower leg covering portion, the heavily-stretchable portion (1) covering that portion of the lower leg which is located below and adjacent to the knee but not covering the knee, and extending substantially longitudinally along the lower leg covering portion along lateral portions thereof but not covering the front of the lower leg. 15 20 25

3. A wearing article as claimed in claim 1, in which the article is a long girdle in which the heavily-stretchable portion (1) covers, in use, all of the front side of the lower half of the human body except for the front sides of the thighs, the knees and the front sides of the lower leg portions. 30

4. A wearing article according to any preceding claim, in which said wearing article is lined with said heavily-stretchable portion (1). 35

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FIG. 1

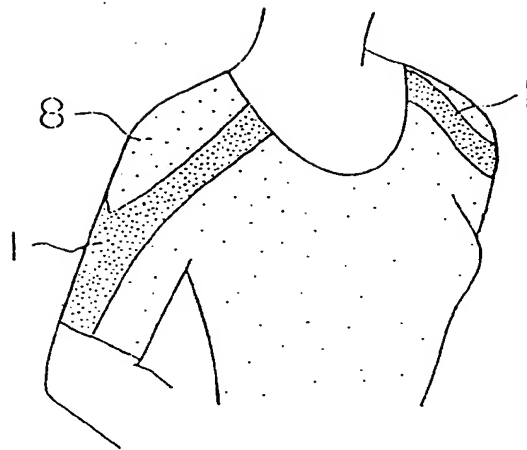


FIG. 2

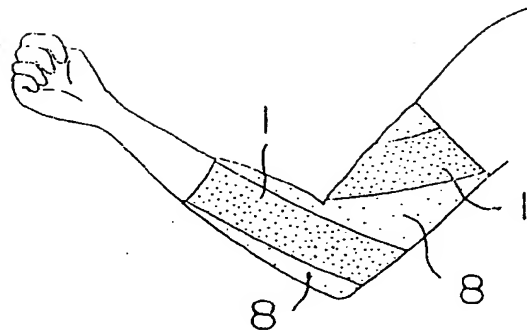


FIG. 3

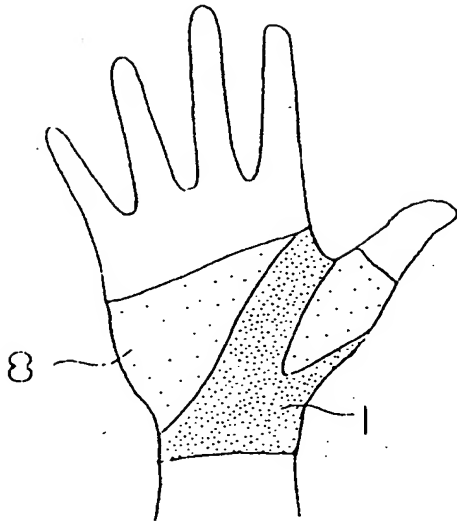


FIG. 4

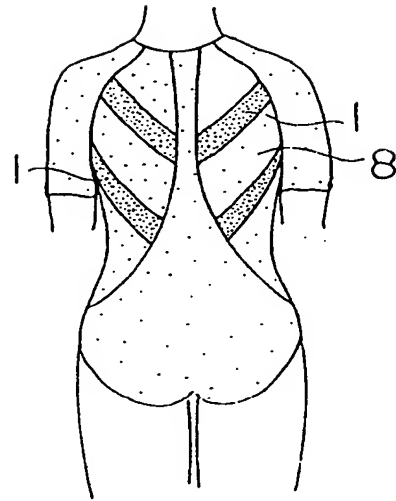
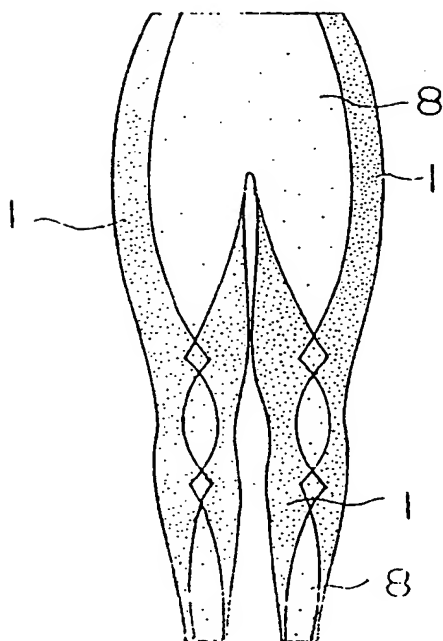


FIG. 5



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FIG. 6

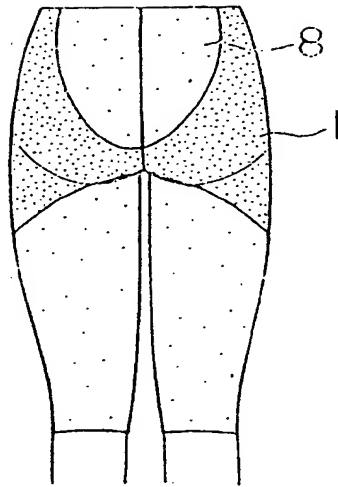


FIG. 7

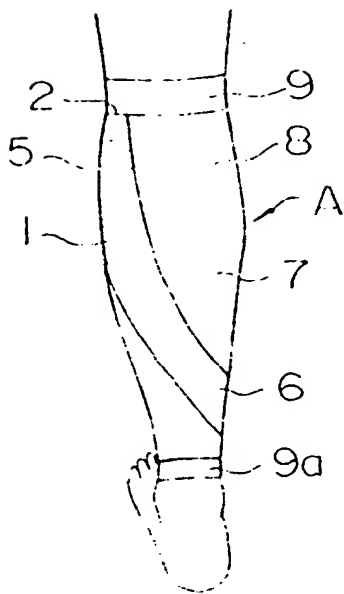
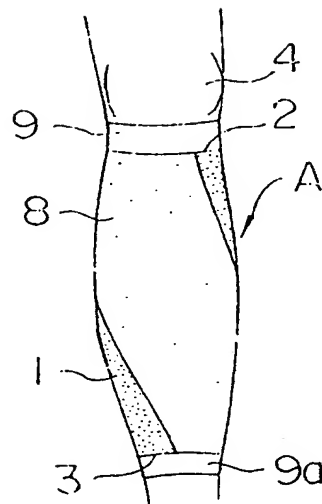


FIG. 8



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FIG. 9

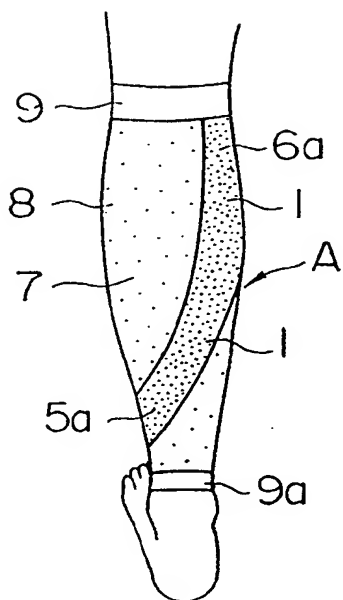


FIG. 10

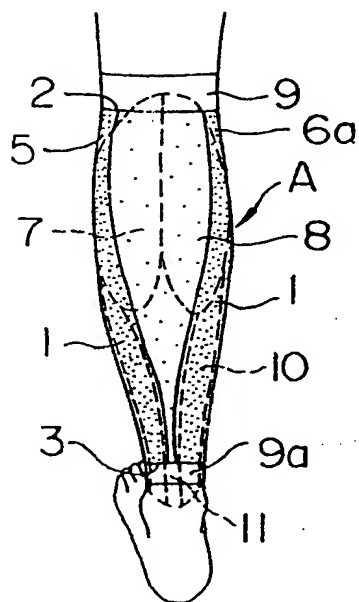
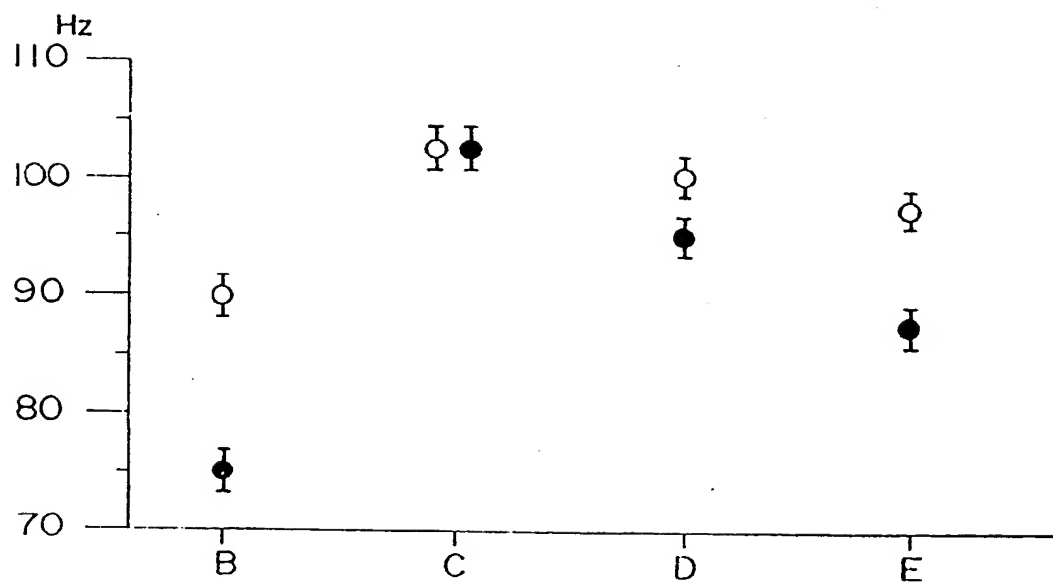
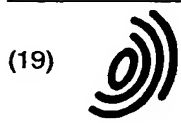


FIG. 11





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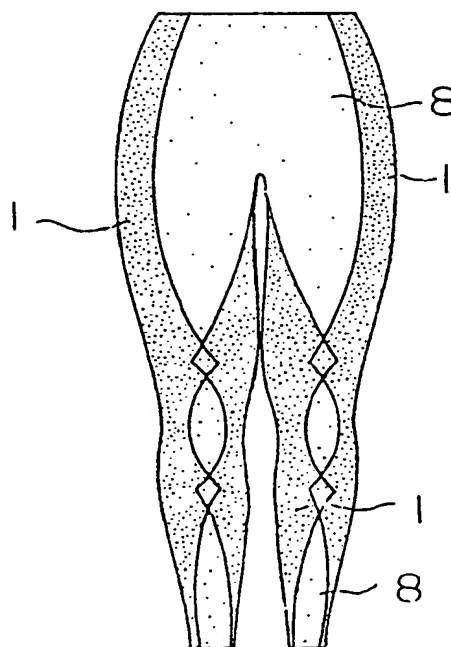
(72) Inventor: **Fujimoto, Masami**  
Shimogyo-ku, Kyoto-shi (JP)

(74) Representative: **Nettleton, John Victor**  
Abel & Imray  
Northumberland House  
303-306 High Holborn  
London, WC1V 7LH (GB)

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**F I G. 5**





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 96 10 2989

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
E	GB-A-2 242 818 (TOKYO EIZAI LAB) 16 October 1991 * the whole document *	1-4	A61F13/00 A61F13/06 A61F13/10 A61F13/14
X	& WO-A-91 01704 21 February 1991 ---	1-4	
X	US-A-4 910 802 (MALLOY EUGENE A) 27 March 1990 * the whole document *	1-4	
A	US-A-4 216 547 (PICCHIONE P VINCENT) 12 August 1980 * the whole document * -----	1-4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A61F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 December 1996	Examiner Argentini, A
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/92 (P04C01)